SUPPLEMENT

Frailty assessment for COVID-19 follow-up – a prospective cohort study

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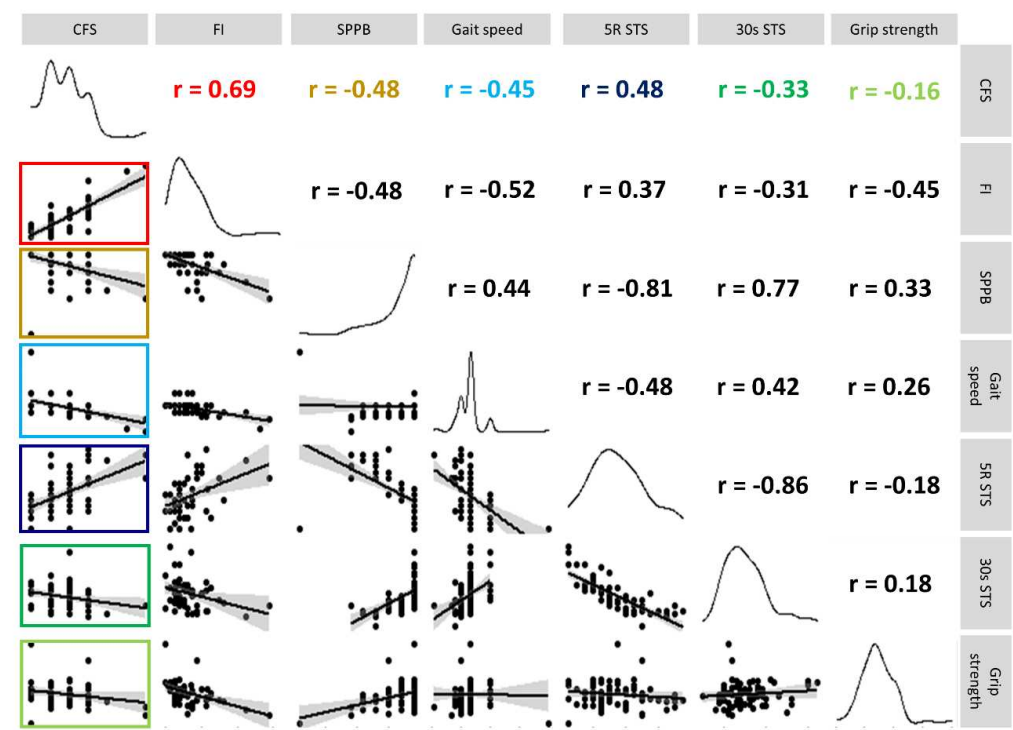
Supplemental measurement details

For the sit-to-stand (STS) test participants were seated upright on a chair of standard height (46 cm) positioned against a wall with knees and hips flexed at 90 degrees, the feet placed flat on the floor hip-width apart, and the hands placed across the chest. They were instructed to place their hands across the chest and to raise from the chair to a standing position as fast as possible for 5 repetitions (5R STS) and as many times as possible in 30 seconds for the 30-second STS. Repetitions were counted manually. The 5R STS is a component of the short physical performance battery (SPPB) and measures functionality and lower extremity muscle strength, whereas the longer 30s STS measures exercise tolerance.[1,2]

Handgrip strength was determined to the nearest kilogram using a Jamar Hydraulic Hand dynamometer. Patients were seated with elbows flexed to 90 degrees and forearms in neutral position. Patients were instructed to squeeze the dynamometer as hard as possible alternating three times for each hand, with the best measurement used for all analyses. Isometric handgrip strength measurement is simple and well validated, including in the Swiss general population, and in patients with chronic obstructive pulmonary disease.[3-5]

Health-related quality of life was measured using the St George's Respiratory Questionnaire (SGRQ), which includes 50-items in three domains relating to symptoms, activity, and impact. The total score that ranges from 0 to 100, with a higher score indicating worse quality of life. The SGRQ was specifically developed for respiratory diseases.[6] The Fatigue Severity Scale (FSS) is a frequently used questionnaire to assess fatigue in individuals with chronic diseases. Each of the 9 items are answered on a 7-point scale ranging from 1 *strongly disagree* to 7 *strongly agree*. The mean was used for the analyses.[7] The modified Medical Research Council (mMRC) dyspnoea scale ranges from 0 (breathless only on strenuous exercise) to 4 (breathless when dressing or undressing or too breathless to leave the house), and is a well-established dyspnea measure.[8] Cough was assessed by cough visual analogue scale (VAS, range 0-10, higher numbers indicate worse cough).

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Figure S1. Criterion validity of the Clinical Frailty Scale.

Abbreviations: CFS, clinical frailty scale; FI, frailty index, SPPB, short physical performance battery; 5R STS, 5 repetitions sit-to-stand; 30s STS, 30-second sit-to-stand

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Table S1. Participant characteristics stratified by hospitalisation for COVID-19.

	No hospitalisation (n=83)	Hospitalisation ward (n=78)	Hospitalisation ICU (n=127)	
	Number (%), mean (SD)			*Missing, n*
Sex, men	42 (51%)	48 (66%)	92 (72%)	-
Age, years	64.4 (9.4)	66.2 (9.4)	64.9 (8.6)	-
Ever smokers %	14 (17%)	26 (33%)	66 (52%)	80
Pack years*	20 (7.8-21.5)	20 (10-20)	25 (16-32.5)	80
Body mass index, kg/m^2	27.7 (5.1)	28.6 (5.7)	29.3 (4.8)	49
COMORBIDITIES				
ILD	0	1 (1%)	4 (3%)	99
COPD	2 (2%)	1 (1%)	7 (6%)	99
Asthma	7 (8%)	9 (12%)	13 (10%)	96
Diabetes	7 (8%)	6 (8%)	27 (21%)	96
Pulmonary embolism	1 (1%)	3 (4%)	4 (3%)	98
Pulmonary hypertension	0	2 (3%)	2 (2%)	98
Arterial hypertension	15 (18%)	28 (36%)	63 (50%)	85
Gastroesophageal reflux	4 (5%)	3 (4%)	15 (12%)	99
Cancer	3 (4%)	4 (5%)	16 (13%)	99
FUNCTIONAL TESTS				
TLC, liters	6.1 (1.2)	5.6 (1.6)	5.4 (1.5)	83
TLC, % predicted	97 (17)	91 (21)	84 (18)	83
FVC, liters	3.7 (0.9)	3.4 (1)	3.4 (1)	52
FVC, % predicted	96 (15)	90 (19)	86 (19)	52
FEV1, liters	2.9 (0.6)	2.6 (0.8)	2.6 (0.8)	52
FEV1, % predicted	97 (13)	91 (17)	89 (21)	52
DLCO, % predicted	88 (21)	82 (20)	71 (20)	74
p$_a$O2, mmHg	79 (17)	79 (15)	79 (11)	115
6-MWD, meters	533 (118)	508 (102)	456 (105)	78
6-MWD, %-predicted	101 (18)	99 (15)	89 (18)	78
O2 nadir on 6MWT	91 (6)	90 (5)	90 (5)	78

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	SYMPTOMS			
mMRC	0.79 (0.9)	0.97 (0.9)	1.15 (1)	10
Cough VAS	0 (0-2)	0 (0-1.5)	0 (0-2)	12
SGRQ total	33.1 (19)	29.4 (21)	34.4 (21)	69
SGRQ impact	20.1 (18)	18.9 (19)	24.8 (21)	69
SGRQ activity	47.5 (25)	42.6 (27)	50.90 (26)	69
SGRQ symptoms	43.1 (24)	37.0 (27)	36.11 (23)	69
	FRAILTY			
CFS pre-COVID-19	2 (1-2)	2 (1-2)	1 (1-3)	123
CFS post-COVID-19	2 (2-3)	3 (2-3)	3 (2-4)	-

Data are presented as mean (standard deviation), median (interquartile range), or frequency (percentage).

Abbreviations: COPD, chronic obstructive pulmonary disease; COVID-19, Coronavirus disease 2019; DLCO, diffusing capacity of the lung for carbon monoxide; FEV1, forced vital capacity in 1 minute; FI, frailty index; FVC, forced vital capacity; ICU, intensive care unit; ILD, interstitial lung disease; mMRC, modified medical research council, P_aO_2, arterial partial pressure of oxygen; SD, standard deviation; SGRQ, St George's Respiratory Questionnaire; SPPB, short physical performance battery; TLC, total lung capacity; VAS, visual analogue scale; 6MWD, 6-minute walk distance; 6MWT, 6-minute walk test. *in ever smokers

Table S2. Individual deficits of the frailty index.

COMORBIDITIES	
1.	Chronic lung disease
2.	Chronic kidney disease
3.	Chronic gastrointestinal disease
4.	Effects of a stroke
5.	Dementia
6.	Epilepsy
7.	Arthritis or arthrosis
8.	Arterial hypertension
9.	Dyslipidemia
10.	Diabetes
11.	Heart disease
12.	Cancer
13.	Problems with urinary or fecal incontinence
14.	Depression
15.	Hypo-/ hyperthyroidism
16.	Weight loss
17.	Anaemia
18.	Immunosuppression
19.	Polypharmacy (≥5 medications)

	INDEPENDENCE & SELF-CARE
20.	Have you recently fallen?
21.	Do you have difficulty walking or do you use a walking aid?
22.	Do you have difficulty carrying light weights?
23.	Do you have restrictions of activity due to poor health?
24.	Do you have body pain that prevents activities?
25.	Do you need help for shopping for necessities?
26.	Do you need help for heaving light household chores? (e.g., washing up)
27.	Do you need help for heaving heavy household chores? (e.g., cleaning windows)
28.	Do you need help for body care?
29.	Do you need help for taking medication?
30.	Do you have impaired vision?
31.	Do you have impaired hearing?
32.	Do you have difficulty speaking?
33.	Do you have problems with eating, drinking or swallowing?
34.	Do you sleep badly?
35.	Do you have difficulty with problem solving?
36.	Do you feel tired all the time?
37.	Do you spend during the day several hours in bed?
38.	Do you feel sad or depressed?
39.	Do you often have fear?
40.	Do you often feel lonely?

Table S3. Unadjusted and adjusted associations with increase in CFS ≥1 pre-/post-COVID-19.

Unadjusted analysis*		
	OR (95% CI)	**p-value**
CFS pre-COVID-19	0.91 (0.45-1.85)	0.80
Hospitalisation	1.80 (0.31-10.4)	0.51
Follow-up time, months	0.86 (0.74-0.99)	0.03
FVC, % predicted	0.98 (0.96-1.00)	0.11
DLCO, % predicted	0.99 (0.98-1.01)	0.46
6MWD, %-predicted	0.98 (0.95-1.00)	0.02
P_aO_2, mmHg	0.99 (0.96-1.02)	0.56
mMRC	1.95 (1.24-3.07)	0.004
SGRQ, total	1.06 (1.03-1.09)	<0.001
Fatigue Severity Scale	1.08 (1.00-1.16)	0.04
Adjusted for age, sex, BMI, smoking, hospitalisation, and follow-up time*		
mMRC	2.11 (1.13-3.94)	0.02
SGRQ, total	1.05 (1.02-1.10)	0.001
Fatigue Severity Scale	1.12 (1.04-1.22)	0.003

Individual models with [*]random effect: patient; fixed effects: age, sex, follow-up time, hospitalisation, BMI, smoking

For example, every one point increase in mMRC is associated with 2.11-times the odds for vulnerability/frailty after accounting for the listed confounders.

Abbreviations: CFS, Clinical Frailty Scale; DLCO, diffusing capacity of the lung for carbon monoxide; FVC, forced vital capacity; mMRC, modified medical research council; OR, odds ratio; P_aO_2, partial pressure of oxygen in arterial blood; SGRQ, St. George's respiratory questionnaire; 6MWD, 6-minute walk distance; 95% CI, 95 percent confidence interval

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